# Report 11297 26 October 1998

# GENCORP AEROJET

Integrated Advanced Microwave Sounding Unit-A (AMSU-A)

Engineering Test Report

METSAT A2 Signal Processor (P/N 1331120-2, S/N F03)

S/N 107

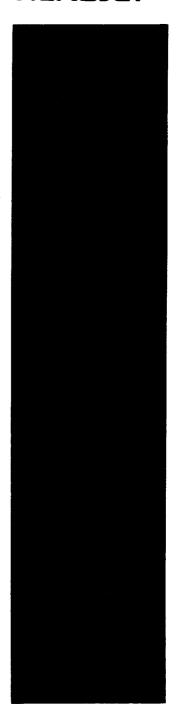
Contract No. NAS 5-32314 CDRL 207

# Submitted to:

National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt, Maryland 20771

Submitted by:

Aerojet 1100 West Hollyvale Street Azusa, California 91702





Integrated
Advanced Microwave Sounding Unit-A (AMSU-A)
METSAT A2 Signal Processor Engineering Test Report
(P/N: 1331120-2, S/N: F03) (Instr. S/N 107)

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#### 1.0 Introduction

This report presents a description of the tests performed, and the test data, for the A2 METSAT Signal Processor Assembly PN: 1331120-2, S/N F03. The assembly was tested in accordance with AE-26754, "METSAT Signal Processor Scan Drive Test and Integration Procedure".

The tests were conducted at room temperature in the AMSU-A test area of building 57. The tests fall into six categories: 1) Continuity, 2) Power Distribution, 3) Digital Processor, 4) Analog Processor, 5) Scan Drive, and 6) Supply Current.

### 2.0 Objective

The objective is to demonstrate functionality of the signal processor prior to instrument integration.

### 3.0 Test Data

All test data is presented on the enclosed copies of the test data sheets (TDSs) numbered TDS 11 through TDS 20 ( Pages A-15 through A-25 ). TDS 11 ( Pg. A15 ) was redlined to incorporate a design change defined in ECN CAMSU-1930. The redline was accomplished in accordance with program directive No. 91 and approved by Quality and the test engineer.

### 4.0 TESTS

## 4.1 Continuity

A complete continuity test of the backplane wiring is performed at the facility where the wirewrapping of the backplane is done. The continuity tests performed here involve 1) the I/O interface card slots, J301 and J324, and 2) chassis return connections. The tests are manual resistance measurement tests. Test data is presented on TDS 11.

## 4.2 Power Distribution

In these tests supply voltages are input to the signal processor from the Test Relay Unit (TRU) as in normal testing. No CCAs are installed in the signal processor for the tests. The test verifies that the four supply voltages are present on the proper pins of all backplane connectors. The test setup block diagram is shown in Figure 1, and test data is presented on TDS 12.

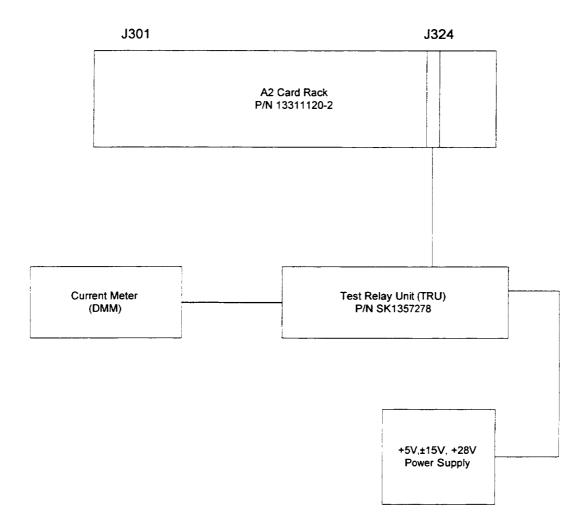


Figure 1. A2 Signal Processor Test Setup

# 4.3 Digital Processor

Beginning with this test, CCAs are installed into the card cage as required to perform the test, and then remain installed. At the conclusion of all tests, a complete set of CCAs has been installed. The complete test setup block diagram which is required for performing any of the tests is shown in Figure 2.

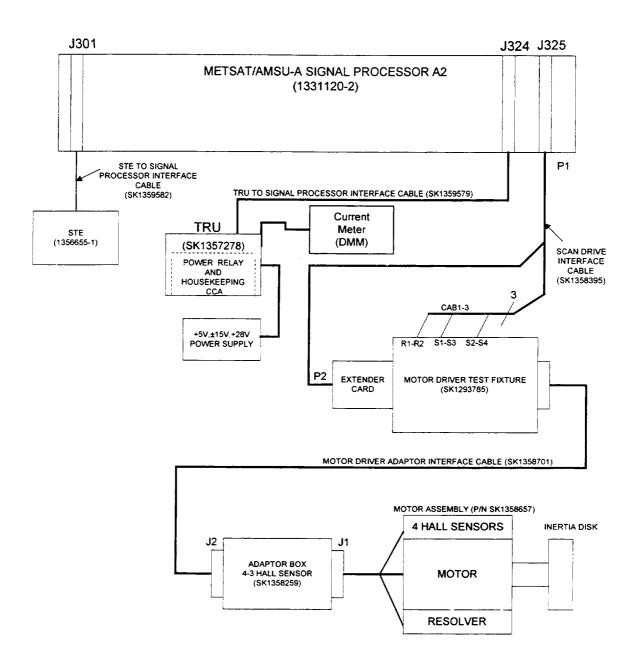


Figure 2. A2 Scan Drive Test Setup

### 4.3.1 Memory

In this test, the digital test set is used in place of the CPU CCA to read and verify data of the test PROMs on the "GOLD" Memory CCA. Test data is presented on TDS 13.

#### 4.3.2 CPU

The CPU test requires that the CPU Auxiliary test CCA be installed in place of the Memory CCA. In this test, the RAM and various instructions performed by the CPU are tested. In addition, the waveform of the clock signal to the DC-DC converter is measured at the CLOCK jack on the TRU. Test data is presented on TDS 13.

#### 4.3.3 Scan Control interface

In this test, input and output ports 0 through 3 are tested. In addition, the disable feature of the input ports is checked out. Test data is presented on TDS 13.

### 4.3.4 Timing and Control

In this test, the proper time intervals of I/H, DUMP, INTCMPL, TSCMPL, STOP, and ANTENNA STROBE are verified. In addition to the above tests, the test set also checks the input ports 16 and 17, output port #13 (4 MSBs), output port 14, input port #15 (DAC BSY signal), and output port #13 (4 LSBs). Test data is presented on TDS 13.

#### 4.3.5 Spacecraft Interface

In this test, the STE is turned on and initialized. The STE is tested with a series of self-tests to verify the readiness of the STE to test flight hardware. After successfully passing the self-tests, the STE is used to simulate the spacecraft command signals and retrieve limited test data for the remaining signal processor tests. STE test data is presented on TDS 14.

### 4.3.6 Relay Control

This test verifies the operation of the module power command and the survival heater command. The presence of the +10 volt Interface power is verified. The Scanner and Compensator relay drive and position indicators are also verified. Test data is presented on TDS 14.

## 4.4 Analog Processor

# 4.4.1 Independence of Measurements

This test is performed using the Analog CCA Test Fixture, the Integrate and Dump Filter and the Analog Mux and A/D Converter CCAs. The test gives a measurement of the sample-to-sample crosstalk within a channel, which is dependent on the completeness of the dump of the integration capacitor. Test data is presented on TDS 15.

### 4.4.2 Integrate/dump filter, radiometric data multiplexing, and digitization tests

In this test, a 2 volt dc signal is input to each integrate and dump filter, and the channel output code from the A/D converter is measured. The integrator output waveform is also displayed on an oscilloscope for verification of timing. Test data is presented on TDS 16.

### 4.4.3 Temperature monitoring circuits

In this test a resistor of value approximating the room temperature of the PRTs is connected at the input of each PRT readout circuit, and the output code from the A/D converter is measured. The reference voltage used in the PRT readout circuits is also measured. Test data is presented on TDS 17.

## 4.4.4 Analog telemetry

In this test each of the analog telemetry signals is measured at the ANALOG HSKP jack on the TRU. Test data is presented on TDS 18.

### 4.5 Scan Drive

This test includes all CCAs involved in the scan drive function. The circuitry is programmed to provide one complete revolution of the drive motor as it steps through each of the thirty scene positions and the two calibration positions. The circuitry is programmed to park at the Warm Cal, Cold Cal, and the Nadir positions during the test sequence. The GSE test modes are also verified. To verify proper performance, the inertia disk on the motor shaft is visually observed through the one revolution and the various calibration positions. Test data is presented on TDS 19.

## 4.6 Supply Current

In this test, the total current drawn by the signal processor from each of the four supply voltages is measured with the signal processor fully populated with CCA's. Test data is presented on TDS 20.

# 5.0 TEST ANOMALIES

No test anomalies occurred during the Signal Processor engineering tests.

### 6.0 TEST RESULTS

The METSAT/AMSU A2 SIGNAL PROCESSOR TEST was successfully completed and all test data is within specified limits.

# TEST DATA SHEET 11 A2 Continuity Tests (Paragraph 5.2.1)

# Enter a Pass or Fail to indicate the result of the tests:

From	То	Signal Name	Pass/Fail
E1	J301-60	CHASSIS GND	٦
E2	J301-90	CHASSIS GND	P
E4	J302-46	CHASSIS GND	P
E3	J324-76	CHASSIS GND	P
J324-73	J312-70	1.248 MHZ PS CLK	P
J324-74	J312-89	5V RTN(1) (1.248 MHZ PS CLK RTN)	P
J324-75	<del>J312-91</del>	5V RTN(1) (PS CLK SHIELD)	

Deleted per ECN CAMSU-1930
Deleted per ECN CAMSU-1930
Plantage
9/17/98

Assembly No. 133/120-2	Shop Order No. 496332	
Serial No. F03	Pass Fail 74	
Test Engineer Double 9/23/98 (Signature (Date)	Quality Control (Signature)	SP 23 98 (Date)
Customer Representative (Flight hardware only)	SEP 24 98 (Signature) (Date)	

# TEST DATA SHEET 12 A2 Power Distribution (Paragraphs 5.2.2 & 5.2.3)

Power Supply Voltages:											
Test Set-u	p Verified:	YE	s	NO				·		· · · · · · · · · · · · · · · · · · ·	
Para. 5.2.3 Step No.	Connector No.	+5 ±0.5V	P/F	+15 ±0.3V	P/F	-15 ±0.3V	P/F	+28 ±0.56V	P/F	+9 ±1V*	P/F
7*	J301									9,436	P
2	J302			14.986	P	-14.99	٩				
3	J303			14.98	٩	-14.99	P				
4	J304			14.98	P	-14-99	P				
5	J305			14.28	P	-14.99	P				
6	J306	4.87	P	14-98	ρ	-14.99	P				
6	J307			14.98	P	-14.99	P				
6	J308	4.87	P							9,436	P
6	J309	4.90	P							9.436	P
6	J310	4.90	Ρ								
6	J311	4.90	P								
6	J312	4.20	P								
6	J313	4.90	P								
6	J315	4.90	P								
6	J317	4.90	P	14.28	P	-14.99	P	27.78	P		
6	J318	4.90	P	14.98	مر	-14-99	٩				
6	J320	4.90	P								
6	J321	4.92	P	14.98	12	-14.99	P				
6	J322	4.92	P	14.98	P	-14.99	P	27.97	P		
6	J323	4.92	P	14.98	P	-14-29	P	27.96	P		
7	J325							27.97	P		
*measured	*measured at parragraph 5.2.5.2. test										
Assembly	Assembly No. 133/120-2 Shop Order No. 496332										
Serial No. <u>F03</u> Pass <u>Fail</u> Fail											
Test Engineer DLud 9/23/98 Quality Control Quality Control											
(Signature (Date) (Signature) (Date)											
Customer Representative (Flight hardware only) (Signature) (Date)											

# TEST DATA SHEET 13 (Sheet 1 of 2) A2 Digital Processor (Paragraph 5.2.4)

1							
CPU (	CCA Serial No. (J312)	F06	<u> </u>				
Scan (	Control Interface CCA Ser	<u></u>					
Timing and Control CCA Serial No. (J311) FO8							
5.2.4.1 Men	nory tests:						
5.2.4.1/10 C	ircle PASS or FAIL to inc	licate the result of the test	s:	Pass Fail			
	If "Fail", record the	error code and error descr	iption.				
	Error Code:	NA	<del></del>				
	Error Descrip	tion: X/A					
5.2.4.2 CPU	tests:						
5.2.4.2/10		Measurements	<u>Limits</u>	Pass/Fail			
	V <sub>p-p</sub>	3.65 Vpp	3.30 - 4.94 V	P			
	Т	3.65 Vpp 802.5ns	761 - 841 ns	802.5 n S 9/23/			
5.2.4.2/19 C	fircle PASS or FAIL to inc	dicate if LEDs indicate CC	CA passed or failed:	Pass Fail			
5.2.4.3 Scan	n Control Interface Tests	<b>:</b>					
5.2.4.3/14	The input ports 0 and 1	l tests		Pass Fail			
5.2.4.3/21	Inhibit input port 0 and	l 1 tests		Pass Fail			
5.2.4.3/29	The input ports 2 and 3	3 tests		Pass Fail			
5.2.4.3/41	The output ports 0 and	1 tests		Pass Fail			
	If "Fail", record the en	or code and error descript					
	Error Code:		<u> </u>				
	Error Descrip	tion: N/A	<u> </u>				

# TEST DATA SHEET 13 (Sheet 2 of 2) A2 Digital Processor (Paragraph 5.2.4)

	•
5.2.4.4 Timir	ng and Control Tests:
5.2.4.4/13	The Integrate and Hold pulse and the Dump pulse at the card rack slot J307. Pass Fail
5.2.4.4/25	The Integrate and Hold pulse and the Dump pulse at the card rack slot J301. Pass Fail
5.2.4.4/35	The Antenna Strobe pulse test.  Pass Fail
5.2.4.4/47	The test of the interface to the Temp. Sensor Analog Mux card rack slot J303. Pass Fail
5.2.4.4/59	The test of the interface to the Analog Mux and Converter card rack slot  Pass Fail  J308.
	If "Fail", record error code and error description:
	Error Code: N/A
	Error Description:
Assembly No	. 1331120-2 Shop Order No. 496332
Serial No	F03 Pass Fail
Test Engineer	(6: ) (1)
Customer Rep	presentative (Flight hardware only) 1. Sandard SEP 24 98
1	(Signature) (Date)

# TEST DATA SHEET 14 A2 Relay Driver Tests (Paragraph 5.2.5.2)

Spaceo	raft Interface #2 (	CCA (J308) Ser. No F / 7		
Spaced	raft Interface #1 (	CCA (J309) Ser. No F 1 7		
Paralle	l to Serial Conver	ter CCA (J310) Ser. No. <u>F/8</u>	· · ·	
Relay 1	Driver And Currer	nt Monitor CCA (J317) Ser. NoF	04	
Test Se	et-up Verified:	Yes No	STE Self Test: Pa	ss Fail
	Step No.	Test Description		Pass/Fail

Step No.	Test Description	Pass/Fail
24	Module power connects	P
30	Survival heater power turns on	12
31	Survival heater power turns off	P
32	Module power disconnects	P
34	Scanner 2 power turns on	P
35	Compensator motor power turns on	P
36	Scanner 2 power turns off	P
36	Compensator motor power turns off	כן
37	Module power disconnect	Р

Assembly No. 1331/20-2	Shop Order No. 496332
Serial No. F03	Pass Fail
Test Engineer (Signature (Date)	Quality Control (Signature) (Date)
Customer Representative (Flight hardware only) (Signature	SEP 24 00 (Date)

# TEST DATA SHEET 15 A2 Independence Of Measurements (Paragraph 5.2.6.1)

Integrate and Dump CCA (J307): Serial No							
Analog Mux and A/D Converter CCA (J306): Serial No							
Test Set-up verified:	YESNO						
Test Set-up vernieu.	110	-					
	Supply (V)	Measured Value (V)	Limits (V)				
	+5	4.8 V	+5 ± 0.25				
	+15	15.8462	+15 ± 1.0				
	-15	-15.426V	$-15 \pm 1.0$				

Channel No.	Average for SIGNAL switch in Hi position	Average for SIGNAL switch in LO position	Measurement Dependence ≤0.01%	Pass/ Fail
0	14096	14094.5	0,00229	P
1	14098.6	14097	0,00244	P
2	14110.5	14108.9	0.00244	P
3	14104	14102.2	0.00275	P

Assembly No. 1331120-2	Shop Order No. 496332
Serial No. Fo 3	Pass Fail
Test Engineer O Sand 9/13/98 (Signature (Date)	Quality Control (Signature) (Qate)
Customer Representative (Flight hardware only) (Signature	(Signature) SEP 24 98 (Date)

# TEST DATA SHEET 16 A2 Integrator Signal Multiplexing, And Digitization (Paragraph 5.2.6.2)

Analog Mux	and A/D Conver	ter CCA(J306):	Ser. No. <u>- [2]</u>	/	•		
Integrate and	Dump/Filter CC	'A (J307):	Ser. No. <u>F 3</u> /	<u> </u>	-	•	
		/1					
Out	put Waveform						
							V2
			32 ±2 ms -				
		Г				ı	
·	Channel	Data	Data Limits	•	Data Pass/Fail	Integrator Waveform Pass/Fail	
	1	27744	26125 to 29757		P	P	
	2	27827	26125 to 29757		בן	P	
		Signal Name		Pass/F	ail		
		ИН		F			
		Dump		P			
		+5 Vdc GSE		F			
		+5 Vdc GSE	Interlock B	<i>F</i>	2		
Assembly No	o. /33//2	10-2	Shop Or	der No.	4963	32	
Serial No	F03		Pass L	_	Fail		
Test Enginee	~ .	9/23/ (Date)	98 Quality	Control	(Signature)		SEP 23 '98 (Date)
Customer Re	presentative (Fli	ght hardware only)	(Signature)	L	(Date)		

# TEST DATA SHEET 17

A2 Temperature Monitoring Circuits (Paragraph 5.2.6.3)

Temperature Sensor Analog Mux CCA (J303) Serial No	FZO
Temperature Sensor B CCA (J304) Serial No	F31
Temperature Sensor A CCA(J305) Serial No.	1207

Dig. A Temp No.	Description	Data	Data Limits	Pass/Fail
1	Scan Motor	31282	28259 to 32513	P
2	Feedhorn	31189	28259 to 32513	P
3	RF MUX	31269	28259 to 32513	P
4	Mixer IF CH 1	31446	28259 to 32513	P
5	Mixer IF CH 2	31244	28259 to 32513	P
6	LO Channel 1	31367	28259 to 32513	م
7	LO Channel 2	31174	28259 to 32513	حر
8	Comp Motor	31317	28259 to 32513	P
9	Subreflector	31070	28259 to 32513	P
10	Dc/Dc Converter	31263	28259 to 32513	P
11	RF Shelf	31514	28259 to 32513	حر
12	Det/Preamp	31245	28259 to 32513	P
13	Warm Load Cntr	22848	20339 to 23401	P
14	Warm Load 1	22488	20339 to 23401	P
15	Warm Load 2	22672	20339 to 23401	P
16	Warm Load 3	22208	20339 to 23401	P
17	Warm Load 4	22508	20339 to 23401	P
18	Warm Load 5	22513	20339 to 23401	P
19	Warm Load 6	22518	20339 to 23401	P
20	Thermal Reference	25233	23340 to 26320	P

Assembly No. / 33 // 20 - 2	Shop Order No. 496332
Serial No. F 03	Pass Fail
Test Engineer Osignature (Date)	Quality Control (Signature) (Date)
Customer Representative (Flight hardware only)	SEP 24 78

# TEST DATA SHEET 18 A2 Analog Telemetry (Paragraph 5.2.6.4)

ANALOG HSKP Switch Position	DVM Reading (V)	Limits (V)	Pass/Fail
1	2,953	2.85 to 3.15	P
2	3.463	3.30 to 3.66	P
. 3	2.984	2.87 to 3.17	P
· 4	2,976	2.85 to 3.15	P
5	3.456	3.30 to 3.66	P
6	2.995	2.87 to 3.17	P
10	3,573 8.7	13.42 to 3.78	حر
12	3.2672.96	2.84 to 3.14	P
13	2.966	2.84 to 3.14	Ρ
21	0.0067	-0.05 to 0.05	P
21	2.958	2.8 to 3.4	P
22	0.0077	-0.05 to 0.05	P
22	2.956	2.8 to 3.4	P

Assembly No. 1331120-2	Shop Order No. 4963 32
Serial No	Pass Fail
Test Engineer (Signature (Date)	Quality Control (Signature) (Pate)
Customer Representative (Flight hardware only)  (Signature	(Date)

# TEST DATA SHEET 19

A2 Scan Drive/Compensator Drive/Signal Processor Tests (Paragraph 5.3.1)

A2 Scan Drive Subsystem	n CCAs:					
Resolver Data Isolator C R/D Converter/Oscillator	CA (J320) Ser. No					
Test Set-up Verified:	Yes No					
Para./Step No.	Mode	Pass/Fail				
5.3.1.2.1/12	Motor in warm cal position	P				
5.3.1.2.2/3	Motor in nadir position.	ρ				
5.3.1.2.3/2	Motor in cold cal position 1	P				
5.3.1.2.3/3	Motor in cold cal position 2	P				
5.3.1.2.3/4	Motor in cold cal position 3	٦				
5.3.1.2.3/5	Motor in cold cal position 4	احر				
5.3.1.2.4/5	Motor in full scan mode	P				
5.3.1.2.5/9	GSE mode 2	P				
5.3.1.2.6/4	GSE mode 4	P				
5.3.1.2.7/4	GSE mode 5	P				
5.3.1.2.8/4	GSE mode 1	P				
5.3.1.2.9/4	GSE mode 3	P				
5.3.1.2.9/7	GSE mode 7	P				
5.3.1.2.10/2	Scan power off	P				
A2 Compensator Drive S	Subsystem CCAs:					
-						
Motor Driver 3-hall Sens	sor CCA (J323) Ser. No					
Test Set-up Verified:	Yes No					
Para./Step No.	Mode	Pass/Fail				
5.3.2.2/4	Compensator motor operation	P				
5.3.2.2/5	Power-off test of compensator motor	P				
Assembly No. 1331120-2 Shop Order No. 496332						
Serial No. F03	Pass Fail	_				
Test Engineer						
Customer Representative	e (Flight hardware only) (Signature) (Date)					
	/ (Signature) (Date)					

# TEST DATA SHEET 20 A2 Supply Currents (Paragraph 5.4)

Voltages	Measured Current	Limits (in mA)	Pass/Fail	
+28.7 V	7.398mA	6 to 12		
+5.7 V	466 mA	400 to 700	P	
+15.7 V	132 mA	100 to 196	P	
-15.7 V	- 155 mA	-110 to -218	P	

Assembly No. 1331120-2	Shop Order No. 496332
Serial No. <u>F03</u>	Pass Fail
(Signature (Date)	Quality Control (Signature) Sp 23 98
Customer Representative (Flight hardware only) (Signatur	(Date)

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